STATEMENT OF BASIS

Modification of Ground Water Discharge Permit UGW350010
Bingham Canyon Mine and Water Collection System
Kennecott Utah Copper

March 12, 2013

Purpose

This Statement of Basis addresses proposed changes to Kennecott Utah Copper (KUC) Ground Water Discharge Permit UGW350010 for the Bingham Canyon Mine and Water Collection System. The primary changes of the permit modification are associated with the East Waste Rock Extension (EWRE) project, which includes the eastward extension of waste rock placement and the relocation of some of the drainage cut-off walls in the East Side Water Collection System. Secondary changes include updates to the permit and appendices since the last renewal of the permit in 2010, including adjustments to ground water protection levels (if needed) for compliance monitoring wells. The modified permit will include the additional infrastructure and replacements to the EWRE, which are discussed in more detail below. The original and modified permit include a number of source control measures, such as the cessation of active leaching of the waste dumps, contaminant cleanup of the Dry Fork area, and adoption of a mine closure plan.

Description of Facilities

Bingham Canyon Mine **-** The KUC Bingham Canyon Mine operations are located in the Oquirrh Mountains approximately 18 miles southwest of Salt Lake City, Utah. This mine produces copper and other metals that are currently extracted using an open pit mining method. Open pit mining operations have been conducted at this site for over 100 years. Facilities included in the mine operations include the truck maintenance shops, warehouses, and mine support activities.

Waste Rock Dumps **-** The waste rock associated with this mining operation has been placed adjacent to the open pit on the slopes of the Oquirrh Mountains. The waste rock disposal areas consist of over five billion tons of waste rock located in two principal areas. These two areas are referred to as the East Side and West Side waste rock dumps. The waste rock consists of low concentrations of sulfide mineralization and trace metals in an intrusive host rock, limestone, and quartzite.

Active leaching of the waste rock dumps ended in October 2000. Previously, parts of the dumps were leached by recycling water collected at the base of the dumps and placing it back on top of the waste rock. Although active leaching by recycling the collected water has stopped, poor quality mine-impacted water is still collected in the water collection system at the base of the dumps. Other portions of the dumps were not actively leached but do generate acidic drainage by virtue of natural precipitation. This water is collected and recycled as process water or discharged under current UPDES permit UT0000051.

The original collection system for the East Side dumps was constructed between 1993 and 1996 and consisted of a series of 26 cut-off walls installed in each drainage downgradient of the waste rock dumps (Drawing 454-T-0118). To augment the effectiveness of each cut-off wall, toe drains and French drains were installed in the formerly leached area from Bluewater 1 to the Copper drainage.

Modification of the collection system is proposed in 2013 to accommodate the continuation of mining, which includes placing waste rock east of the existing East Side dumps (Figures 1 and 2). This proposed project is generally referred to as East Waste Rock Extension (EWRE). In this effort, the nine cut-off walls between Copper drainage and Congor drainage will be replaced by 12 new cut-off walls of similar design to those originally constructed (Drawing 454-T-0119). Where modifications take place, the modified collection system employs a toe drain beginning at Copper drainage and ending at Midas drainage where it overlaps the existing toe drain collection system in Midas drainage. The newly installed collection system runs continuously along the entire eastern toe of the new waste rock dump between Copper and Midas drainages and acts a as the primary means of collecting mine-impacted water. The new cut-off walls act as a secondary collection point for mine-impacted water.

The collected water is conveyed by high density polyethylene (HDPE) pipelines to South Area Water Services (SAWS) for metal extraction, or to the Large Reservoir for recycling. Following the extraction of copper, the collected water is stored in the lined Bingham Reservoirs (permit UGW350006) and discharged to the Tailings Impoundment (permit UGW350011) as process water in the tailings line.

Leach water was applied to the Dry Fork waste rock dump until 1999. In addition to the cut-off wall in lower Bingham Canyon, ground water extraction wells are located in Bingham Canyon and Dry Fork. These wells are designed to either intercept ground water impacted by the historic leach water applications or to capture clean water before it comes in contact with waste rock.

SXEW Operations **-** KUC has conducted a pilot scale Solvent Extraction/Electrowinning (SXEW) project on a lined and monitored area on the Dry Fork dump. The pilot plant was decommissioned in 1999. Current plans as of 2009 include use of the leach pad on the Dry Fork dump for heap leach test work. Pregnant leach solution from this test facility is either used in pilot SXEW operations adjacent to the heap leach or can be piped to the Process Plant at the mouth of Bingham Canyon. Efforts to complete a full scale SXEW facility at the mouth of Bingham Canyon began in 2008 and were put on hold in 2009. The extent of SXEW operations is dependent on a variety of future market conditions.

Bluewater Repository **-** The Bingham Canyon Mine and Water Collection System ground water quality discharge permit incorporates the previous ground water permit issued for the Bluewater Repository. Each segment of the repository includes a leachate collection system that routes flows to the leach collection pipeline. The Bingham Canyon Mine and Water Collection System ground water quality discharge permit includes pertinent portions of the former Bluewater Repository ground water quality discharge permit.

Site Hydrogeology

Tertiary volcanic rocks are the primary stratigraphic unit that underlies the majority of the East Side waste rock dumps. There is a thin layer of unsaturated alluvial and colluvial material under parts of the waste rock dumps. Beneath the Tertiary volcanics are quartzites and limestones of Paleozoic age. The Paleozoic bedrock beneath the Dry Fork waste rock dump area is highly fractured and is more permeable than the bedrock beneath the other waste rock dumps. Beneath most of the dumps, water tends to perch at the waste rock/bedrock contact, but in the Dry Fork area some of the leach water infiltrated into the underlying bedrock during leaching operations. To the east of the waste rock disposal areas, the Tertiary volcanics and Paleozoic sediments are covered by Plio-Pleistocene alluvial deposits. These deposits thicken to the east to form the principal aquifer in the Southwest Salt Lake Valley[1].

The Salt Lake Valley is generally characterized as having a shallow unconfined and a principal confined aquifer system. Confining layers are generally not present or discontinuous near the base of the mountains and are more pronounced towards the center of the valley[2]. Except for a thin veneer of alluvial material in the area from the Copper drainage northward to the Bluewater drainage, KUC's East Side waste rock dumps and water collection system are located on top of Tertiary volcanic rocks that transition to the alluvial aquifer system to the east of and down gradient from the collection system. Based on mapping of recharge areas completed by the U.S. Geological Survey, KUC's former East Side leaching operations are immediately adjacent to the primary recharge area for the west side of the Salt Lake Valley[2].

Background Ground Water Quality

Water quality in the principal aquifer adjacent to the East Side waste rock dumps is somewhat variable. Effects of historic mining practices are evident in some areas. Generally the water quality downgradient of the non-leached waste rock dumps has a total dissolved solids (TDS) value between 500 mg/l and 3,000 mg/l making it Class II Drinking Water Quality Ground Water. There are a few areas that exhibit Class IA Pristine Ground Water with TDS values less than 500 mg/l. In areas impacted by acidic waters, a typical water quality signature is Class III Limited Use Ground Water with elevated values of TDS, sulfate, magnesium, copper, cadmium and zinc.

Basis for Permit Issuance

KUC has proposed a discharge minimization approach coupled with source control for this ground water discharge permit. Discharge minimization will be achieved through the use of an upgraded cut-off wall/collection system along the East Side dumps and East Waste Rock Extension. A major source control step was completed with the cessation of active leaching in 2000.

Containment and Control Technology - A typical cut-off wall configuration for the East Side waste rock dumps is depicted on drawing 451-T-9080. Cut-off wall design modifications applicable to the drainages from Copper to Congor are depicted in Figure 3. Cut-off walls have been placed in all principal drainages along the perimeter of the East Side waste rock dumps. The site for each wall was excavated to bedrock to allow the wall to be keyed into bedrock. Along with the concrete cut-off wall, a collection basin is installed immediately upstream of the cut-off wall. From Bluewater 1 south to the Midas drainages, the collection basins upstream of the cut-off walls are lined with HDPE material and seepage collection trenches extend from each side of the wall to the top of the local drainage catchment. These trenches are excavated to bedrock, lined with clay, and have a perforated collector pipe laid in a filter-cloth enclosed gravel drain on top of the clay liner. The trenches augment interception of subsurface flow in the thin veneer of alluvial material and route the water to the collection basin behind the cut-off wall.

In the modified collection system extending from Midas south to Copper drainage, seepage is captured along the toe of the dump using a trench system, which employs dual 12-inch perforated pipe etched into bedrock and lined with clay, which directs water via piping to drainage bottoms and the cut-off wall. The wall acts as a secondary collection system and employs a 6-inch perforated pipe along the base of the wall to capture water seepage not collected by the trench. The modified system also employs storm water detention basins which manage surface water separately from subsurface water (Figure 3). The intent of these basins will help reduce maintenance requirements that are associated with scale, which forms when two sources of water of varying water quality comingle and generate precipitates. Storm water will be transported separately by HDPE piping to the Bingham Canyon Reservoir. Waters collected at a cut-off wall are directed via HDPE pipeline to the collection system.

The pipelines for the water collection system lie adjacent to a concrete lined canal, which acts as a secondary means of conveyance for the collected water. The canal is designed primarily for storm water conveyance and secondarily to convey mine-impacted water during upset conditions. The canal is also used as a secondary containment structure for water piped from Bingham Tunnel and/or Lark Shaft to the Large Reservoir and/or the Waste Water Disposal Pump Station. The canal can also be used to capture water generated from upset conditions such as a pipeline break. The concrete ditch is not used for routine conveyance of mine impacted water.

Flows from the Dry Fork waste rock dump and other West Side dumps that drain into the Bingham Canyon are contained and collected as follows with specific permit conditions outlined in Table 4 and discussed in detail in Appendix G (well locations can be identified in drawings 454-T-0415 and 454-T-0416):

1. Two clean water extraction wells (Mid Valley and Picnic Flats) are maintained in upper Dry Fork Canyon to capture water before it contacts the waste rock dumps and underlying contaminated ground water. The wells are screened predominately in alluvium. Water is collected by the Mid Valley well (COP2701) and the Picnic Flats well (COG1172) and routed to the Copperton Concentrator for use as process water.

2. The Bingham Creek cut-off wall was constructed at the mouth of Bingham Canyon in 1995-1996 to collect subsurface alluvial flow in the Bingham Creek drainage. The scale of this wall is considerably larger than other cut-off walls constructed for the East Side dumps in that time period. The depth of the excavation to bedrock was in excess of 100 feet. The wall is over 300 feet across at the top with a maximum thickness of 24 feet at its base. Alluvial flows are collected by the wall through pumping and are ultimately sent to the tailings pipeline.

3. An alluvial extraction well identified as the Copperton Channel well (ECG1185) is located in the Copperton channel, a small alluvial channel which underlies the town of Copperton. The well was commissioned for alluvial extraction in 2006, and is screened between 130 and 200 feet below ground surface to capture subsurface alluvial flows. Flows captured in this channel are ultimately sent to the tailings pipeline.

4. An alluvial extraction well identified as Bingham Creek (ECG2787) was installed in Bingham Canyon in 2009. The well is screened in alluvium between 75 and 129 feet below ground surface and extracts mine-impacted water from the surrounding alluvium. This well is located downgradient of the Bingham Canyon waste rock dump. Under normal operating conditions, water from this well is sent to the P-plant for copper recovery.

5. An alluvial extraction well identified as Curtis Springs (K83) has operated in Bingham Canyon since 2006. The well is located downgradient of ECG2787 and is screened in alluvium between 46.5 and 96.5 feet below ground surface. Flows reporting to and captured by this well are contingent upon seasonal conditions and the performance of ECG2787. Water extracted from this well is ultimately sent to the tailings pipeline.

The Bingham Canyon Mine pit acts as a large ground water collection basin in this portion of the Oquirrh Mountains. On average, KUC removes water from the pit, on a continuous basis, at a rate of approximately 1,000 gallons per minute. There are several water quality issues related to mine closure, which are addressed in the closure plan. The majority of these issues appear to be related to pit water accumulation and drainage, as well as flows from a variety of tunnels associated with mine operations.

Monitoring Approach

A monitoring well network of 41 wells is utilized for compliance monitoring of the Bingham Canyon Mine and Water Collection System. Thirty-four (34) of these wells are located on the East Side (Drawing 454-T-0118 and Permit Limit Table 1) and seven (7) wells are located in the Dry Fork area (Drawing 454-T-0415 and Permit Limit Table 2). In addition, wells listed in Permit Limit Table 3 will be used for additional informational monitoring on the East Side and within the Dry Fork/Bingham Canyon area. Prior to 2004, only fifteen (15) wells were used for compliance monitoring. In 2004, thirty (30) wells were added to the existing compliance monitoring network.

The primary objective of the compliance monitoring well network is to measure any water quality impacts that may occur to the principal aquifer system from KUC operations. Permit limits are based on monitoring the effectiveness of the upgraded cut-off walls, source controls, and collection system. Where possible, East Side well locations were selected to provide completions in the saturated aquifer system to the east of the waste rock disposal areas where at least 50 to 100 feet of saturation exists. In the southern portion of the East Side waste rock disposal area and areas immediately downgradient of the cut-off walls; compliance monitoring wells are completed in bedrock because no saturated alluvial deposits exist.

The seven compliance wells located in the Dry Fork/Bingham Canyon area (Permit Limit Table 2) are screened in bedrock and are sited to confirm that contamination is not migrating out of the Dry Fork/Bingham Canyon area via bedrock flow paths. These compliance monitoring wells are all located upgradient of the Bingham Canyon cut-off wall.

Permit limits for pH, TDS, sulfate, dissolved cadmium, copper and zinc (Permit Limit Table 1) were established in 1999 for the original 15 compliance wells, in 2004 for the additional compliance wells, and subsequently adjusted in 2010 to account for the full history and data available for each compliance well. These parameters were selected as good indicators of mine-impacted water. The permit limits established in 1999 were based on monitoring data collected over a period of four to five years, while limits established in 2004 and 2010 were based on monitoring data collected over 10 and 15 years, respectively.

Permit limits will not be established for the eight Dry Fork compliance wells (Permit Limit Table 2) until they have been re-established upon the completion of waste rock disposal activities in the area. Permit limits for these wells will be based upon 12 quarterly samples, collected as the wells are re-established.

Two of the original compliance monitoring wells (ECG938 and ECG1189) have shown very little indication of mining impacts. If compliance monitoring data indicate no change in water quality after a period of five years, KUC may propose removing these wells from the list of compliance monitoring wells.

KUC has proposed using well ECG1184 located at the mouth of Butterfield Canyon as the compliance well for the waste rock dumps that are tributary to Butterfield Canyon. This well would act in place of the five compliance wells completed in bedrock located in the Butterfield Canyon vicinity. The proposed well is completed in alluvial materials and would require a mass balance approach to identify waste rock influences from stream flows, tunnel flows, and unaffected bedrock ground water flow influences. The Division has not included this approach in the current permit. KUC has the option to collect data and make a demonstration that this approach is viable, although the permit does not require this.

Operational monitoring for this permit includes flow and water quality sampling of mine-impacted waters from the collection system, tunnel flows, leachate from repository sumps, seeps (if present), informational wells, and extraction wells.

One of the technical issues associated with the monitoring well system is the ability to distinguish contamination that is historical in nature from contamination that has a recent origin. Prior to the installation of the upgraded cut-off wall system in 1994-1996, the old cut-off wall system was in operation. The old cut-off wall system was not as effective and loss of leach water was significant. In addition, the velocity of ground water in the bedrock material is quite slow based on numerous hydraulic conductivity tests conducted by KUC. It is very likely that the contaminated ground water present in the vicinity of some monitoring wells is from a time frame that precedes the installation of the upgraded cut-off wall system. The monitoring well system will need to distinguish between historic contamination and more recent contamination, which would indicate the upgraded cut-off wall system is not performing properly. KUC completed several studies to age date and identify the source of ground water and contamination in the area to provide clarification on this issue (DWQ-2001-001082, DWQ-2002-001141 and DWQ-2002-001101).

Basis for Specific Permit Conditions

1. Bluewater Repository – The Bingham Canyon Mine and Water Collection System permit incorporates the previous ground water discharge permit for the Bluewater Repository. Two standing conditions from that permit are needed to address future construction of the clay liner or clay cap. The first item requires KUC to comply with the Quality Assurance/Quality Control (QA/QC) Plan approved for the Bluewater Repository ground water discharge permit. The second item requires submittal of an "As Built" report within 60 days of final completion of new segments of the cap or liner, which documents that the construction conformed to the approved design and QA/QC requirements.

2. Permit Renewal Application Items – To assist in permit renewals every five years, this condition requires KUC to submit a water quality summary of the previous data collected for operational sites, compliance monitoring wells, and surface water sites. The ground water report submitted on an annual basis fulfills this requirement. The report will include an analysis of trends and changes in water quality over the life of the permit.

3. Closure Plan – Acidic drainage from the waste rock dumps will continue to be generated from meteoric water long after the Bingham Canyon Mine ceases operations. In addition, ground water will inundate a portion of the pit and may flow out of the pit via tunnels. A conceptual closure plan has been submitted to DWQ to address the water quality related closure issues associated with the mine and waste rock disposal areas (Bingham Canyon Mine 2003 Reclamation and Water Management Plan). The conceptual closure plan will be updated and submitted for review in conjunction with major changes and revisions to both the permit and the plant that directly affect closure strategy. A final closure plan is due one year prior to final closure. Included in the closure plan will be preliminary designs and a schedule to minimize infiltration of meteoric water through the waste rock and low-grade ore stockpiles.

4. SXEW Plans and Specifications – KUC is currently conducting a pilot scale leaching program on a lined portion of the Dry Fork Waste Rock Dump as well as a pilot scale solvent extraction/electrowinning (SXEW) project. The original pilot scale SXEW plant associated with the heap leach piles was discontinued in the late 1990's and planned for demolition. However, this condition is included in the Bingham Canyon Mine and Leach Collection System Ground Water Quality Discharge Permit to require KUC to provide detailed plan modifications and specifications for any future SXEW operations. Plans and specifications should be submitted 180 days prior to the planned start of construction of these facilities. The plans and specifications must be approved by the Division Director.

5. Contingency for Installation of a Bedrock Extraction Well in Bingham Canyon – If bedrock compliance monitor wells K93 and ECG2789A&B at the mouth of Bingham Canyon begin to show signs of contaminant plume migration, KUC will refer to Section 4 of Appendix G of permit UGW350010 for guidance on how to proceed. Installation of a bedrock extraction well at the base of the lower Bingham Canyon dumps to combat any further migration of a deep bedrock plume will be assessed by DWQ and KUC. KUC and UDWQ will refer to Section 4 of Appendix G of this permit as well as compliance limits established for the wells as per the accelerated sampling program outlined in Table 2 for guidance regarding pumping well installation.

References

1. Bingham Canyon Mine East Side Collection Monitoring Network Ground Water Discharge Permit Application. Kennecott Utah Copper, April 1996.

2. Hydrogeology of recharge areas and water quality of the principal aquifers along the Wasatch Front and adjacent areas, Utah. U.S. Geological Survey Water Resources Investigations Report 93-4221. P.B. Anderson, D.D. Susong, S.R. Wold, V.M. Heilweil, and R.L. Baskin, 1994.